

Brooke Energy, Waste Processing Yard, Exeter

Noise Assessment





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1 INTRODUCTION

- 1.1 Entran Ltd has been commissioned to undertake a noise assessment for the Brooke Energy Waste Processing Facility located at Brooke Biomass, Exeter.
- 1.2 The site is home to a 420kWe, 4.2MWth biomass-fuelled CHP, providing electricity for use within the industrial park upon which it sits and for export to the National Grid. The waste heat from the process is used within the fuel drying process.
- 1.3 The focus of this assessment is the waste wood handling process, which has been annexed to the site, in order to provide fuel for the CHP. It is understood that this part of the process is currently the subject of EA enforcement action, requiring an Environmental Permit to continue to operate.
- 1.4 The purpose of this assessment is to establish the existing noise climate at the site and, if necessary, formulate mitigation measures to protect existing noise sensitive receptors. Relevant national/local guidance on noise sources is presented in Section 3. Section 5 of this report presents the results of the surveys undertaken for the site. The assessment of noise is considered in Section 6 together with our recommendations for mitigation. Our conclusions are summarised in Section 7.
- 1.5 This Report is necessarily technical in nature and contains terminology relating to acoustics and noise. Therefore, a glossary together with a brief introduction to the subject of noise has been provided in Appendix A.

2 SITE DESCRIPTION

2.1 The Application Site comprises an L-shaped parcel of hard-surfaced land, adjacent to the Brooke Energy 420kWe, 4.2MWth biomass-fuelled CHP and is defined by the following grid reference points:

- North-West: E:300672 N:091250
- North-East: E:300731 N:091200
- South-East: E:300677 N:091127
- South-West: E:300637 N:091159
- West (internal): E:300657 N:091188
- West (external): E:300636 N:091203

2.2 The site location, within the context of the wider industrial estate is identified on Figure 1.

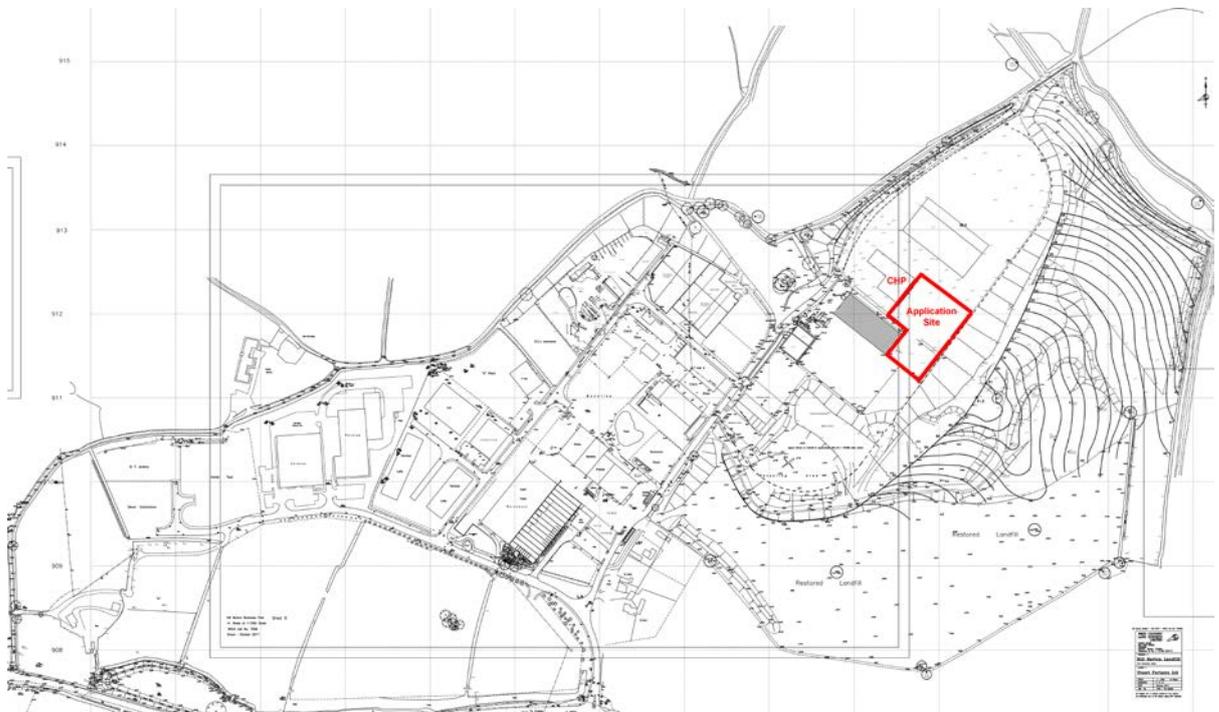


Figure 1: Application Site Location



2.3 This assessment and Permit Application focuses on the use of the Application Area of the site for the receipt, screening, shredding, separation and storage of waste wood materials for use within the adjacent CHP, thus supplementing the use of imported biomass material. All plant used within the Application Site will be mobile and comprise the following:

- Doppstadt SM620 Trommel Screen (E:300702 N:091209);
- Haas 2000 Primary Shredder (E:300703 N:091197);
- Willibald SR 5000 Secondary Shredder (E:300696 N:091186);
- Strobe ECS 1500 Separator (E:300699 N:091179);
- 2 No. JCB TM 320 Front-End Wheeled Loader (entire site); and
- Hyundai 210 LC-9 Tracked Back Actor with Material Grab Attachment (E:300692 N:091207).

2.4 The Application Site will give rise to waste wood material delivery trips, anticipated to be within the traffic profile already consented under the CHP permit (typically up to 5 per day), due to the offsetting effect of replacing biomass fuel deliveries with waste wood material deliveries, for processing on-site. The site will also operate during the daytime hours only; typically between 07:00 and 18:00 daily.

2.5 Although mobile in its nature, the plant will operate in the locations illustrated in Figure 2 and centred on the grid references set out above. Additionally, the waste reception and storage areas, processing area waste skips, quarantine areas and processed waste storage areas will be bound by the grid referenced locations set out below:

- Waste Reception and Storage: E:300666 N:091222
- Skips: E:300721 N:091194
- Quarantine: E:300675 N:091140
- Processed Waste Storage: E:300656 E:091155



Figure 2: Site Layout



3 NATIONAL PLANNING GUIDANCE

National Planning Policy Framework

- 3.1 The National Planning Policy Framework (NPPF)¹ published on the 27th March 2012 sets out the Government's economic, environmental and social planning policies for England. It summarises in a single document all previous national planning policy advice. Taken together, these policies articulate the Government's vision of sustainable development, which should be interpreted and applied locally to meet local aspirations.
- 3.2 The NPPF sets out the Government's requirements for the planning system only to the extent that it is relevant, proportionate and necessary to do so. It provides a framework within which local people and their accountable councils can produce their own distinctive local and neighbourhood plans, which reflect the needs and priorities of their communities.
- 3.3 Under Section 11; Conserving and enhancing the natural environment, the following is stated:

The planning system should contribute to and enhance the natural and local environment by:

- *Preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability.*

- 3.4 The document goes on to state:

Planning policies and decisions should aim to:

- *Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
- *Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;*
- *Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and*

¹ Department for Communities and Local Government, March 2012. National Planning Policy Framework. HMSO.



- *Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.*
- As stated above, this document makes reference to avoiding noise generation from new developments that would adversely impact on health and quality of life.

Planning Practice Guidance – Noise

3.5 The National Planning Practice Guidance (NPPG²) has been revised and updated to be easily accessible and available online.

3.6 The Noise Guidance advises on how planning can manage potential noise impacts in new developments. It sets out when noise is relevant to planning and outlines the following Observed Effect Levels to determine the noise impact:

- *Significant observed adverse effect level: This is the level of noise exposure above which significant adverse effects on health and quality of life occur.*
- *Lowest observed adverse effect level: this is the level of noise exposure above which adverse effects on health and quality of life can be detected.*
- *No observed effect level: this is the level of noise exposure below which no effect at all on health or quality of life can be detected.*

3.7 The document recognises the subjective relationship between noise levels and the impact on those affected, and advises on factors which may influence on whether noise could be a concern.

National Planning Practice Guidance, England

3.8 Further guidance in relation to the National Planning Policy Framework and the Noise Policy Statement for England has been published in the National Planning Practice Guidance in England: Noise (NPPG)³, which summarises the noise exposure hierarchy, based on the likely average response.

3.9 This is reproduced in Table 1, below.

² National Planning Practice Guidance, Department for Communities and Local Government (DCLG), March 2014

³ Department for Communities and Local Government (DCLG), 2014. National Planning Practice Guidance for England: Noise. DCLG.



Table 1: Significance Criteria from NPPG in England: Noise

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
		Lowest Observed Adverse Effect Level	
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
		Significant Observed Adverse Effect Level	
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent



4 NOISE ASSESSMENT CRITERIA

BS4142:2014 'Method for Rating and assessing industrial and commercial sound'

- 4.1 For the purposes of this assessment, external noise levels at nearby noise sensitive receptors (e.g. residential use) have been derived on the basis of the guidance given in BS4142.
- 4.2 BS 4142 sets out a method to assess noise from factories, industrial premises or fixed installations and sources of an industrial nature in commercial premises. The methods described in this British Standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.
- 4.3 The procedure contained in BS 4142 for assessing the likelihood of an adverse impact is to compare the measured or predicted noise level from the source in question, the $L_{Aeq,T}$ 'specific noise level', immediately outside the dwelling with the $L_{A90,T}$ background noise level.
- 4.4 Where the noise contains a distinguishable discrete continuous note (whine, hiss, screech, hum etc.) or if there are distinct impulses in the noise (bangs, clicks, clatters or thumps), or if the noise is irregular enough to attract attention then a correction is added to the specific noise level to obtain the $L_{A,r,T}$ 'rating noise level'. The likelihood of an adverse impact is assessed by subtracting the background noise level from the rating noise level. BS 4142 states:
- a) Typically, the greater this difference, the greater the magnitude of the impact.
 - b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
 - c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
 - d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.



- BS4142 further qualifies the above:

The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context.

Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.

Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including the following.

1) The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.

Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.

Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.

2) The character and level of the residual sound compared to the character and level of the specific sound. Consider whether it would be beneficial to compare the frequency spectrum and temporal variation of the specific sound with that of the ambient or residual sound, to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound. Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the way in which sound of an industrial and/or commercial nature is likely to be perceived and how people react to it.



Consideration ought to be given to evidence on human response to sound and, in particular, industrial and/or commercial sound where it is available.

3) The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:

i) Facade insulation treatment;

ii) Ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and

iii) Acoustic screening.



5 ENVIRONMENTAL NOISE MEASUREMENTS

- 5.1 Existing noise conditions in the vicinity of the site have been determined by an environmental noise survey conducted during Tuesday 24th April 2018.
- 5.2 The plant associated with the Application Site was operated at full capacity on land already covered by the CHP operating permit (immediately to the south of the proposed operational location) throughout the day of measurement, for the purposes of quantifying the noise emissions, both from each individual item of plant and in terms of the cumulative noise effects at the closest off-site receptor properties. In terms of off-site effects, this location was deemed to be acoustically similar, with negligible differences in source to receiver separation distances and similar screening.
- 5.3 Consequently, the key sources of noise within the site could be identified and rank ordered, alongside an exercise that enabled the direct measurement of operational (ambient) and non-operational (residual/background) noise levels at the critical, off-site locations.
- 5.4 All noise measurements were undertaken by a consultant certified as competent in environmental noise monitoring, and, in accordance with the principles of BS 7445: 2003: *Description and measurement of environmental noise* and following the guidance given in BS 4142.
- 5.5 All acoustic measurement equipment used during the noise survey conformed to Type 1 specification of British Standard 61672: 2013: *Electroacoustics. Sound level meters. Part 1 Specifications*. A full inventory of this equipment is shown in Table 2 below:

Table 2: Inventory of Acoustic Measurement Equipment

Item	Make & Model	Serial Number	Calibration Due	Certificate Number
1: Sound Level Meter	Rion NL-52	00943282	08/02/2019	1702075
1: Microphone	Rion UC-59	07045	08/02/2019	1702075
1: Pre-amplifier	Rion NH-25	43298	08/02/2019	1702075
2: Sound Level Meter	Rion NL-52	00764926	23/02/2020	TRCT18/1183
2: Microphone	Rion UC-59	12922	23/02/2020	TRCT18/1183
2: Pre-amplifier	Rion NH-25	76427	23/02/2020	TRCT18/1183
3: Sound Level Meter	Norsonic 116	20252	10/11/2018	23066
3: Microphone	Norsonic 1225	91779	10/11/2018	23066
3: Pre-amplifier	Norsonic 1201	19133	10/11/2018	23066
Calibrator	Cirrus CR:515	72886	27/10/2018	TRAC17/10424



-
- 5.6 The noise measurement equipment used during survey was calibrated at the start and end of the measurement period. The calibrator used had itself been calibrated by an accredited calibration laboratory within the twelve months preceding the measurements. No significant drift in calibration was found to have occurred on any of the sound level meters.
- 5.7 The microphones were fitted with protective windshields for the measurements, which were carried out under free-field conditions, at the locations described below and illustrated on Figure 3. The weather conditions during the survey were conducive to noise measurement, it being dry with wind speeds of less than 5 ms⁻¹.
- A noise measurement; MP1 was carried out adjacent to the western boundary of Glebe Lodge (E:301247 N:091179), under free-field conditions, at a height of 1.5 metres above local ground level, which was deemed to be robustly representative of the sound climate environment at the closest residential receptor to the west of the Site. The sound environment at this location was influenced by distant and local road traffic (associated with the wider uses of the industrial estate), in addition to general commercial activity noise from within the industrial estate (after 07:00) and agricultural activity (tractors) within the surrounding fields.
 - A noise measurement; MP2 was carried out adjacent to the northern boundary of the closest property to the south, adjacent to Stuart Way (E:300375 N:090922), under free-field conditions, at a height of 1.5 metres above local ground level, which was deemed to be robustly representative of the sound climate environment at the closest residential receptor to the south of the Site. The sound environment at this location was influenced by distant and local road traffic (associated with the wider uses of the industrial estate), in addition to general commercial activity noise from within the industrial estate (after 07:00) and agricultural activity (tractors) within the surrounding fields.
 - A noise measurement; MP3 was carried out adjacent to the eastern boundary of the Site, on top of the 17-metre high earth embankment (E:300739 N:091179), under free-field conditions, at a height of 1.5 metres above local ground level. The sound environment at this location was influenced by sound emanating from the on-site operations, including static and mobile plant operations, during orchestrated peak operation plus sound from the wider operations within the industrial estate during both operational and non-operational periods.



Figure 3: Noise Monitoring Locations

- 5.8 The existing noise climate in the area is affected by distant and local road traffic (associated with the wider uses of the industrial estate), in addition to general commercial activity noise from within the industrial estate (after 07:00) and agricultural activity (tractors) within the surrounding fields. As stated earlier in this section, the Permit Application Site was run at full/typical capacity for part of the day, for the purposes of this noise assessment, during which time, 2 No. HGV movements were noted at the site, but at no time, was any activity attributable to the Application Site audible at the off-site residential receptor locations.
- 5.9 The noise measurement results are summarised in Table 3, with full-tabulated results and measured time histories presented in Appendix B. The 'mode value' (as per BS4142 requirement) for the $L_{A90,T}$ background level has been extracted from the data and presented.



Table 3: Summary of Noise Measurement Results

Location	Period	Noise Level, dB			
		L _{Aeq,T}	L _{A90}	L _{A10}	L _{AFMax}
MP1	Source On (10:30 to 16:40)*	49.9	47.0	51.5	64.4
	Source Off (10:15 to 10:30 and 13:00 to 13:30)	49.7	47.0	51.2	62.8
MP2	Source On (14:20 to 15:00)	54.3	49.0	56.3	68.9
	Source Off (05:30 to 06:30)	54.1	45.0	56.7	79.5
MP3	Source On (09:50 to 16:35)*	65.7	53.0 / 67.0	64.0	77.9
	Source Off (13:00 to 13:30)	60.0	54.0	61.8	77.3

* denotes, period between 13:00 and 13:30 excluded

5.10 A full set of spectral source noise measurement results is presented in Table 4, below.

Table 4: Source Noise Measurement Results – Sound Pressure Level L_{eq} - dB

All Plant at 20 metres from Edge of Operational Area – 74.8 dB(A)										
12.5Hz	16Hz	20Hz	25Hz	31.5Hz	40Hz	50Hz	63Hz	80Hz	100Hz	125Hz
57.0	69.5	62.8	65.3	67.4	68.7	69.0	70.7	71.5	76.0	69.9
160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz
69.8	69.4	70.5	71.7	68.4	66.5	65.0	64.6	64.6	64.5	61.9
2kHz	2.5kHz	3.15kHz	4kHz	5kHz	6.3kHz	8kHz	10kHz	12.5kHz	16kHz	20kHz
63.1	60.7	58.2	56.8	53.4	51.0	47.8	44.0	38.8	31.4	21.1
Doppstadt SM620 Trommel at 1m from Tumbler Side – 87.0 dB(A)										
12.5Hz	16Hz	20Hz	25Hz	31.5Hz	40Hz	50Hz	63Hz	80Hz	100Hz	125Hz
70.3	94.1	82.8	71.4	75.1	79.4	77.5	79.5	79.7	86.0	75.4
160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz
77.9	80.8	79.6	80.9	80.5	79.9	80.2	80.3	77.8	75.4	74.3
2kHz	2.5kHz	3.15kHz	4kHz	5kHz	6.3kHz	8kHz	10kHz	12.5kHz	16kHz	20kHz
72.1	70.0	69.6	67.5	66.2	64.8	64.1	61.9	59.3	56.3	50.5
Doppstadt SM620 Trommel at 1m from Engine Side – 86.6 dB(A)										
12.5Hz	16Hz	20Hz	25Hz	31.5Hz	40Hz	50Hz	63Hz	80Hz	100Hz	125Hz
66.5	79.5	71.5	71.4	76.2	76.9	77.2	84.8	76.3	79.5	78.2
160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz
77.3	78.7	79.4	82.2	81.6	80.3	78.6	77.8	73.4	71.7	77.3
2kHz	2.5kHz	3.15kHz	4kHz	5kHz	6.3kHz	8kHz	10kHz	12.5kHz	16kHz	20kHz
71.2	69.9	69.4	66.0	66.0	61.7	59.3	57.3	54.8	51.7	45.3
Haas 2000 Primary Shredder at 5m – 90.3 dB(A)										
12.5Hz	16Hz	20Hz	25Hz	31.5Hz	40Hz	50Hz	63Hz	80Hz	100Hz	125Hz
60.7	69.6	64.0	64.4	72.1	73.8	77.9	82.5	76.6	83.5	76.7
160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz
76.5	73.4	77.4	77.5	76.1	79.0	78.4	79.6	79.4	80.3	80.7
2kHz	2.5kHz	3.15kHz	4kHz	5kHz	6.3kHz	8kHz	10kHz	12.5kHz	16kHz	20kHz
82.1	78.9	78.1	76.6	73.2	70.0	67.4	64.0	60.1	52.4	42.9
Willibald SR 5000 Secondary Shredder at 3m – 90.4 dB(A)										
12.5Hz	16Hz	20Hz	25Hz	31.5Hz	40Hz	50Hz	63Hz	80Hz	100Hz	125Hz
72.8	84.5	73.5	72.1	82.0	81.2	80.4	88.2	84.5	84.8	77.7
160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz
79.0	81.4	84.1	86.7	83.0	86.0	82.2	81.9	79.6	79.0	77.9
2kHz	2.5kHz	3.15kHz	4kHz	5kHz	6.3kHz	8kHz	10kHz	12.5kHz	16kHz	20kHz
76.2	74.7	73.9	72.6	70.9	68.0	67.1	66.6	60.5	54.1	45.5
Strobe ECS 1500 Separator at 2m – 85.3 dB(A)										
12.5Hz	16Hz	20Hz	25Hz	31.5Hz	40Hz	50Hz	63Hz	80Hz	100Hz	125Hz
66.2	83.6	72.8	71.1	77.5	79.9	77.6	77.7	80.4	83.8	78.3
160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz



78.7	78.2	78.0	77.2	79.2	81.3	78.0	76.0	75.7	74.2	72.4
2kHz	2.5kHz	3.15kHz	4kHz	5kHz	6.3kHz	8kHz	10kHz	12.5kHz	16kHz	20kHz
70.6	69.5	68.1	67.1	64.6	62.6	60.9	59.5	55.0	50.3	42.7
JCB TM 320 Wheeled Loader Reversing at 2m – 91.9 dB(A)										
12.5Hz	16Hz	20Hz	25Hz	31.5Hz	40Hz	50Hz	63Hz	80Hz	100Hz	125Hz
61.0	77.1	68.8	74.3	76.4	74.1	76.7	82.2	74.5	76.1	75.3
160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz
74.6	74.7	74.0	74.7	77.5	77.4	75.6	74.4	75.7	90.7	71.4
2kHz	2.5kHz	3.15kHz	4kHz	5kHz	6.3kHz	8kHz	10kHz	12.5kHz	16kHz	20kHz
66.9	73.9	66.2	72.2	61.3	63.2	58.4	53.7	50.4	44.8	36.7
JCB TM 320 Wheeled Loader Revving Engine at 1m – 89.0 dB(A)										
12.5Hz	16Hz	20Hz	25Hz	31.5Hz	40Hz	50Hz	63Hz	80Hz	100Hz	125Hz
63.2	76.8	71.0	72.2	73.7	76.1	78.6	84.3	84.7	79.3	81.3
160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz
86.6	87.9	87.8	86.8	82.6	84.1	81.6	79.9	77.2	75.6	74.0
2kHz	2.5kHz	3.15kHz	4kHz	5kHz	6.3kHz	8kHz	10kHz	12.5kHz	16kHz	20kHz
72.5	69.9	68.3	65.8	63.3	60.3	58.3	55.4	52.4	47.7	40.1
Hyundai 210 LC-9 Loading Trommel at 2m from Unit Body – 85.8 dB(A)										
12.5Hz	16Hz	20Hz	25Hz	31.5Hz	40Hz	50Hz	63Hz	80Hz	100Hz	125Hz
64.0	73.3	66.9	69.7	74.6	76.1	76.4	81.2	82.6	83.4	79.0
160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz
81.4	80.2	80.5	75.9	75.9	79.6	79.0	77.9	74.7	75.3	73.8
2kHz	2.5kHz	3.15kHz	4kHz	5kHz	6.3kHz	8kHz	10kHz	12.5kHz	16kHz	20kHz
73.1	71.8	70.2	68.9	66.0	63.3	60.8	58.6	52.5	46.5	38.4
Lorry Being Loaded by JCB TM 320 at 3m – 85.8 dB(A)										
12.5Hz	16Hz	20Hz	25Hz	31.5Hz	40Hz	50Hz	63Hz	80Hz	100Hz	125Hz
61.6	73.2	67.4	68.9	75.4	77.5	78.6	84.8	79.3	80.1	76.2
160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz
75.4	76.3	84.9	78.6	76.1	77.1	74.7	78.0	75.7	75.0	74.6
2kHz	2.5kHz	3.15kHz	4kHz	5kHz	6.3kHz	8kHz	10kHz	12.5kHz	16kHz	20kHz
76.2	72.4	69.1	67.1	64.2	61.0	58.0	54.7	50.5	44.4	34.8
Centre of Operational Area at ~5m from All Plant – 87.9 dB(A)										
12.5Hz	16Hz	20Hz	25Hz	31.5Hz	40Hz	50Hz	63Hz	80Hz	100Hz	125Hz
66.4	81.3	70.9	69.5	76.1	80.1	79.2	82.3	83.8	86.0	79.6
160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz
78.6	76.8	79.7	81.5	81.8	83.2	80.3	79.8	78.2	76.2	75.2
2kHz	2.5kHz	3.15kHz	4kHz	5kHz	6.3kHz	8kHz	10kHz	12.5kHz	16kHz	20kHz
74.7	72.7	71.3	70.0	66.9	64.5	63.1	63.3	56.1	49.5	41.2



6 NOISE ASSESSMENT

- 6.1 It is typical for such assessments for a desktop noise modelling exercise to be undertaken, in order to predict the likely noise effects of a development at off-site, noise-sensitive receptors in the vicinity; however, in this case, the opportunity existed to artificially orchestrate the full operation of the Site at an acoustically equivalent location and undertake direct off-site measurements of its effects at existing residential and key reference locations in the area, with the benefit of light, downwind propagation.
- 6.2 This approach has removed the introduction of inherent inaccuracies that are inevitably introduced into the assessment process by the limitations ISO9613 prediction methodology, which is incorporated into the noise modelling process. The ISO9613 methodology becomes particularly limited where very substantial noise barriers, such as that located to the east and south of this site, are introduced, where the full screening effects of such barriers are seldom replicated.
- 6.3 Nevertheless, while this orchestrated operation was underway, the opportunity was taken to determine the source noise levels of each key plant item and process associated with the operation, such that modelling can be undertaken in the future should any changes be applied to or intensification of the processes or site layout be proposed in the future. The results of that noise source measurement exercise are presented within this report for completeness and to help illustrate the effectiveness of the mitigation measures currently employed at and around the Site.
- 6.4 As previously stated within this report, observations undertaken during the measurement exercise at receptors surrounding the Site, concluded that activities associated with the process forming the subject of this Permit Application were entirely inaudible at all existing off-site receptor locations, as a result of the noise mitigating effects of the substantial earth bund to the east of the Application Site boundary and the baseline noise environment, which is influenced by the proliferation of commercial activities within the industrial estate.
- 6.5 Consequently, as the sound environment at off-site receptor locations is not audibly or measurably influenced by activities associated with the Permit Application, a detailed, objective BS4142 assessment is not possible on the basis of the ambient and residual measurement data, but a robust conclusion can be drawn that noise associated with activities within the Site are substantially below the prevailing background sound levels at these receptors.



6.6 Therefore, we can robustly conclude that the full operation of the Site equates to a *Low Impact* in BS4142 terms and No Observed Effect (NOEL) in terms of the PPG England definitions.



7 CONCLUSIONS

- 7.1 Entran Ltd has been commissioned to undertake a noise assessment for the Brooke Energy Waste Processing Facility located at Brooke Biomass, Exeter.
- 7.2 The site is home to a 420kWe, 4.2MWth biomass-fuelled CHP, providing electricity for use within the industrial park upon which it sits and for export to the National Grid. The waste heat from the process is used within the fuel drying process.
- 7.3 The focus of this assessment is the waste wood handling process, which has been annexed to the site, in order to provide fuel for the CHP. It is understood that this part of the process is currently the subject of EA enforcement action, requiring an Environmental Permit to continue to operate.
- 7.4 The purpose of this assessment is to establish the existing noise climate at the Site and, if necessary, formulate mitigation measures to protect existing noise sensitive receptors. Relevant national/local guidance on noise sources is presented in Section 3. Section 5 of this report presents the results of the surveys undertaken for the site. The assessment of noise is considered in Section 6 together with our recommendations for mitigation. Our conclusions are summarised in Section 7.
- 7.5 The full operation of the Site was artificially orchestrated, such that direct observation and measurement under operational and non-operational conditions could be undertaken at the closest noise-sensitive receptors to the Site. This was particularly useful due to the nature of the topography adjacent to the Site and the limitations of noise prediction methodologies to accurately predict the effects of such.
- 7.6 It was concluded that the sound environment at the closest noise-sensitive receptors to the Site was not audibly or measurably influenced by the activities associated with the Site and, as such, equated to a Low Impact in terms of BS4142 and a NOEL in terms of the PPG England definitions.
- 7.7 Consequently, noise should not be considered an impediment to the granting of an Environmental Permit for the Waste Wood Processing and storage activities at the Site.



APPENDIX A – INTRODUCTION TO NOISE

In order to assist the understanding of acoustic terminology and the relative change in noise, the following background information is provided.

The human ear can detect a very wide range of pressure fluctuations, which are perceived as sound. In order to express these fluctuations in a manageable way, a logarithmic scale called the decibel, or dB scale is used. The decibel scale typically ranges from 0 dB (the threshold of hearing) to over 120 dB.

The ear is less sensitive to some frequencies than to others. The A-weighting scale is used to approximate the frequency response of the ear. Levels weighted using this scale are commonly identified by the notation dB(A).

A noise impact on a community is deemed to occur when a new noise is introduced that is out of character with the area, or when a significant increase above the pre-existing ambient noise level occurs. For levels of noise that vary with time, it is necessary to employ a statistical index that allows for this variation. These statistical indices are expressed as the sound level that is exceeded for a percentage of the time period of interest.

In the UK, traffic noise is measured as the L_{A10} , the noise level exceeded for 10% of the measurement period. The L_{A90} is the level exceeded for 90% of the time and has been adopted to represent the background noise level in the absence of discrete events. An alternative way of assessing the time varying noise levels is to use the equivalent continuous sound level, L_{Aeq} . This is a notional steady level that would, over a given period of time, deliver the same sound energy as the actual fluctuating sound.

To put these quantities into context, where a receiver is predominantly affected by continuous flows of road traffic, a doubling or halving of the flows would result in a just perceptible change of 3dB, while an increase of more than 25%, or a decrease of more than 20%, in traffic flows represent changes of 1dB in traffic noise levels (assuming no alteration in the mix of traffic or flow speeds).

Note that the time constant and the period of the noise measurement should be specified. For example, BS 4142 specifies background noise measurement periods of 1 hour during the day and 15 minutes during the night. The noise levels are commonly symbolised as $L_{A90(1hour)}$ and



$L_{A90(15\text{mins})}$. The noise measurement should be recorded using a 'FAST' time response equivalent to 0.125 ms.

Table A1: Glossary of Terms

Term	Definition
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s_1 and s_2 is given by $20 \log_{10} (s_1/s_2)$. The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is $20\mu\text{Pa}$.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
$L_{eq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level during the period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{90,T}$	A noise level index. The noise level exceeded for 90% of the time over the period T. L_{90} can be considered to be the "average minimum" noise level and is often used to describe the background noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Ambient Noise Level	The totally encompassing sound in a given situation at a given time, usually composed of a sound from many sources both distant and near ($L_{Aeq,T}$).
Residual Noise Level	The ambient noise remaining at a given position in a given situation when specified sources are suppressed to a degree such that they do not contribute to the ambient noise level ($L_{Aeq,T}$)
Specific Noise Level	The equivalent continuous A-weighted sound pressure level at the assessment position produced by the specific noise source (the noise source under investigation) over a given time interval ($L_{Aeq,T}$)
Rating Noise Level	The specific noise level plus any adjustment for the characteristic features of the noise ($L_{Ar,Tr}$).



APPENDIX B – FULL NOISE MEASUREMENT RESULTS

Table B1: MP1 Tabulated Noise Measurement Results - dB

Date & Time	L _{Aeq,5-min}	L _{A90,5-min}	L _{A10,5-min}	L _{AFMax}
10:15	45.4	43.6	46.8	50.7
10:20	49.8	45.5	51.5	62.8
10:25	47.0	44.6	48.7	56.3
10:30	46.7	44.7	48.7	58.4
10:35	47.0	44.8	48.7	53.8
10:40	47.5	45.0	49.2	55.8
10:45	45.8	44.1	47.1	53.3
10:50	45.5	43.5	46.9	55.4
10:55	46.8	44.8	48.5	53.8
11:00	46.2	44.5	47.6	56.4
11:05	46.3	44.2	47.8	60.3
11:10	47.0	44.6	48.9	56.4
11:15	46.4	44.7	47.6	53.5
11:20	49.6	45.7	52.5	60.5
11:25	49.3	46.2	51.6	60.0
11:30	50.4	46.8	53.1	58.3
11:35	50.8	47.5	53.2	59.4
11:40	50.9	47.5	53.1	59.2
11:45	49.6	45.6	51.9	63.8
11:50	53.2	47.6	56.6	64.2
11:55	51.4	48.6	53.7	57.2
12:00	50.5	47.6	52.8	58.0
12:05	51.7	47.3	54.3	61.8
12:10	51.9	47.9	54.5	65.2
12:15	54.3	49.4	56.3	67.9
12:20	50.7	47.0	53.2	61.9
12:25	48.4	46.8	49.9	58.0
12:30	48.0	46.5	49.5	52.1
12:35	49.3	46.9	51.0	54.6
12:40	48.5	45.2	50.4	53.8
12:45	48.5	46.0	50.1	65.7
12:50	50.4	48.1	52.1	57.6
12:55	50.4	48.0	52.1	54.7
13:00	50.3	47.6	52.7	57.1
13:05	48.4	45.2	50.6	53.8
13:10	50.4	46.9	52.9	58.2
13:15	50.4	47.1	53.2	55.9
13:20	51.2	47.7	53.7	58.1
13:25	51.7	48.8	54.1	56.8
13:30	51.3	47.4	54.5	59.0
13:35	51.0	45.8	53.9	64.3



13:40	46.4	44.6	48.1	54.2
13:45	47.4	45.0	49.4	55.9
13:50	52.1	48.2	54.5	64.4
13:55	49.3	46.3	51.5	57.5
14:00	51.0	47.2	52.8	72.5
14:05	54.9	49.3	57.8	73.3
14:10	49.5	47.6	51.2	53.9
14:15	49.9	48.0	51.4	56.7
14:20	51.3	48.7	53.4	62.9
14:25	50.1	47.6	52.0	57.8
14:30	49.5	47.1	51.3	57.0
14:35	49.6	47.9	50.9	60.2
14:40	50.3	47.7	52.3	59.6
14:45	49.5	47.1	51.4	57.5
14:50	51.3	48.3	53.5	57.7
14:55	50.6	47.2	52.8	61.0
15:00	51.6	47.5	54.6	61.2
15:05	48.9	46.1	51.3	57.7
15:10	49.8	47.3	51.8	55.5
15:15	49.6	46.5	51.4	59.9
15:20	48.9	46.7	50.7	57.6
15:25	49.4	45.2	52.5	59.5
15:30	49.3	46.7	51.3	55.2
15:35	49.7	47.3	51.4	55.0
15:40	50.2	48.0	52.7	56.9
15:45	50.3	47.1	53.0	56.4
15:50	51.3	47.1	54.5	58.6
15:55	50.3	47.2	52.6	61.1
16:00	48.3	46.5	49.9	55.3
16:05	50.0	46.1	52.8	59.6
16:10	48.0	46.0	49.6	56.7
16:15	48.9	46.8	50.7	52.9
16:20	47.3	45.5	48.7	51.6
16:25	46.3	44.9	47.5	51.5
16:30	49.6	46.2	51.8	61.2
16:35	48.1	45.5	50.0	58.6

Grey shading denotes "source off" periods



Figure B1: MP1 Measured Time History

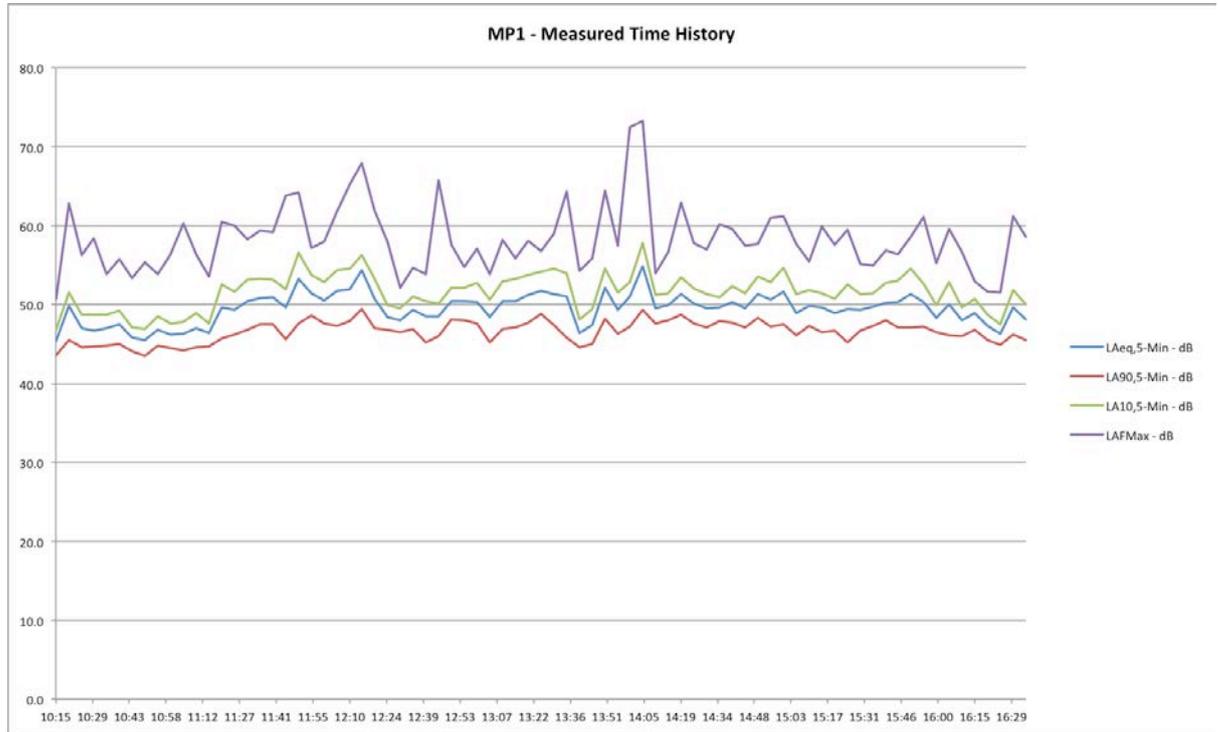


Table B2: MP2 Tabulated Noise Measurement Results - dB

Date & Time	L _{Aeq,5-min}	L _{A90,5-min}	L _{A10,5-min}	L _{AFMax}
05:25	55.2	44.9	57.2	78.6
05:30	54.5	44.5	57.3	79.5
05:35	53.5	46.8	56.9	65.4
05:40	53.4	47.9	56.7	61.1
05:45	55.9	48.5	57.4	80.3
05:50	54.1	45.1	56.8	74.3
05:55	53.9	44.3	57.4	68.6
06:00	53.4	45.0	56.4	70.2
06:05	52.3	47.6	55.3	72.2
06:10	53.2	48.5	55.5	75.7
14:20	54.3	49.8	56.7	65.5
14:25	53.4	49.3	55.9	62.7
14:30	54.9	49.2	56.5	67.1
14:35	54.6	51.7	56.6	68.9
14:40	54.7	49.3	56.9	72.0
14:45	54.5	51.6	56.8	63.8
14:50	53.7	50.7	55.8	61.4
14:55	54.2	50.1	55.2	66.6

Grey shading denotes "source off" periods



Table B3: MP3 Tabulated Noise Measurement Results - dB

Date & Time	L _{Aeq,5-min}	L _{A90,5-min}	L _{A10,5-min}	L _{AFMax}
09:50	61.1	53.1	65.8	74.9
09:55	54.4	49.9	56.5	68.3
10:00	55.0	49.3	56.0	68.5
10:05	57.6	51.4	59.0	77.4
10:10	56.5	48.9	57.8	75.5
10:15	57.5	53.7	58.7	76.6
10:20	58.5	53.0	60.3	77.1
10:25	53.7	50.5	55.2	70.6
10:30	54.0	49.7	55.9	69.3
10:35	50.5	48.7	51.4	64.1
10:40	52.7	48.7	53.7	73.4
10:45	57.7	50.1	60.6	75.7
10:50	56.4	51.1	55.7	77.9
10:55	57.5	51.4	59.2	77.5
11:00	56.7	51.5	58.6	76.5
11:05	58.1	53.0	60.2	76.6
11:10	61.6	55.2	64.5	77.9
11:15	56.8	53.8	58.7	71.0
11:20	59.5	53.8	63.2	71.1
11:25	64.2	59.8	67.3	74.0
11:30	68.6	60.7	71.4	76.0
11:35	64.0	54.4	68.0	74.5
11:40	55.7	52.6	57.8	72.3
11:45	57.6	52.7	60.6	71.0
11:50	58.9	53.0	62.5	72.2
11:55	57.8	53.3	60.6	73.6
12:00	56.2	52.8	57.4	73.1
12:05	59.0	53.2	64.1	70.7
12:10	58.3	53.4	61.8	69.2
12:15	62.1	55.7	64.9	73.3
12:20	56.7	54.1	58.9	67.7
12:25	56.2	54.0	57.5	64.0
12:30	55.4	53.8	56.6	63.0
12:35	56.7	54.0	58.9	70.5
12:40	56.0	53.4	57.8	70.9
12:45	57.6	53.8	60.2	71.8
12:50	56.0	53.6	57.4	70.6
12:55	57.4	54.0	59.1	75.3
13:00	58.7	53.5	59.6	78.8
13:05	58.9	53.7	58.9	74.8
13:10	59.6	53.2	62.0	77.1
13:15	61.3	53.6	64.9	77.3



13:20	57.7	54.1	59.5	73.2
13:25	62.2	54.4	65.6	76.9
13:30	55.0	52.8	56.6	68.2
13:35	57.0	53.1	59.5	70.8
13:40	55.5	53.3	56.8	66.7
13:45	55.0	53.6	56.4	60.7
13:50	61.3	54.2	64.8	75.2
13:55	62.8	57.7	66.6	76.3
14:00	68.3	59.0	71.9	76.4
14:05	71.8	70.5	72.9	80.9
14:10	71.4	69.9	72.6	76.9
14:15	71.0	69.6	72.2	75.4
14:20	71.0	69.6	72.2	76.3
14:25	70.4	68.2	71.8	74.4
14:30	70.2	68.8	71.4	77.5
14:35	70.1	68.4	71.4	82.0
14:40	69.7	68.0	71.0	77.1
14:45	69.0	66.9	70.6	74.7
14:50	69.2	67.4	70.6	77.2
14:55	69.8	67.5	71.4	79.3
15:00	70.9	67.6	73.0	80.9
15:05	69.3	67.6	70.8	74.8
15:10	69.4	67.8	70.8	76.7
15:15	69.3	67.3	70.7	80.5
15:20	69.7	67.8	71.2	83.6
15:25	68.9	67.1	70.3	75.1
15:30	69.3	67.6	70.6	74.7
15:35	68.9	67.3	70.3	74.5
15:40	68.6	66.6	70.0	76.3
15:45	69.0	67.1	70.3	77.3
15:50	68.9	67.0	70.2	80.1
15:55	68.6	67.1	69.8	75.6
16:00	65.4	56.3	68.6	75.8
16:05	64.7	57.1	66.9	81.0
16:10	62.4	56.1	66.4	74.6
16:15	62.3	56.4	65.5	77.3
16:20	60.6	56.1	62.8	73.9
16:25	60.6	56.0	63.6	71.7
16:30	60.4	54.7	63.9	76.4
Grey shading denotes "source off" periods				



Figure B2: MP3 Measured Time History

